Total number of printed pages–11

3 (Sem–2/CBCS) CHE HC 1

2022

CHEMISTRY

(Honours)

Paper : CHE–HC–2016

(Organic Chemistry–I)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer ***any seven*** questions : 1×7=7

(a) Out of the following, which one exhibits positive inductive (+*I*) effect ?

(i) $-CH_3$

(ii) $-OH$

(iii) $-F$

(iv) $-C_6H_5$

Contd.

(b) BCl_3 is a planar molecule whereas NCl_3 is pyramidal. Why ?

(c) Find the optically active compound among the following :

(i) Glycerine

(ii) Acetaldehyde

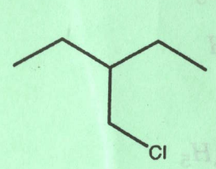
(iii) Glyceraldehyde

(iv) Acetone

(d) Are the following molecules enantiomers, diastereomers or same ?

(R,R)-Tartaric Acid and (R,S)-Tartaric Acid

(e) Write the IUPAC name of the following compound :



(f) Write the name of the reaction when alkyl halide is allowed to react with metallic sodium in presence of dry ether.

(g) Name the products formed when propene is subjected to ozonolysis.

(h) What are products obtained when alkenes are subjected to hydroxylation ?

(i) Define angle strain.

(j) Explain why are alkynes more acidic than alkenes and alkanes.

2. Answer ***any four*** questions from the following : 2×4=8

(a) Explain why $(CH_3)_4N^+$ is neither an electrophile nor a nucleophile.

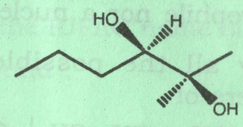
(b) Draw all the possible geometrical isomers of
$CH_3-CH=CH-CH=CH-C_2H_5$.

(c) What are the similarities and differences between achiral and meso compounds ?

(d) Peroxides are good initiators for radical reactions. Given the peroxide RO-OR, draw the initiation and propagation step of the peroxide radical to create bromine radical with HBr.

(e) With proper stereochemistry, write the products obtained when 1,2-dimethylcyclopentene is reacted with Br_2.

(f) Give a reaction scheme starting with alkene and required reagents to produce the following compound :



(g) Draw the most stable conformations of *cis*-and *trans*-1,2-dimethylcyclohexane.

(h) Draw the Newman projection formula of the eclipsed and staggered conformers of 1,2-dichloroethane.

3. Answer ***any three*** questions : 5×3=15

(a) State the differences between substitution and elimination reaction. What are the factors that determine whether a reaction will follow substitution mechanism or elimination mechanism ? 2+3=5

(b) What are carbenes ? Give *one* method of preparation of carbene. Write the structures of singlet and triplet methylene. 1+2+2=5

(c) With the help of examples, explain 2.5×2=5

(i) conformation and

(ii) configuration

(d) A tertiary alkyl halide **A** of formula $C_6H_{13}Br$ on treatment with potassium *t*-butoxide gives two isomeric alkenes **B** and **C** having the formula C_6H_{12}. Both of these alkenes on hydrogenation give 2,3-Dimethylbutane **D**. Predict the products and write the reactions involved.

(e) Write the E1cB mechanism of elimination reaction. How does it differ from E1 mechanism ? 3+2=5

(f) Hydrogenation of Hex-3-yne produces cis-and trans-Hex-3-ene under different reaction conditions. Write the reactions involved. How can you convert Hex-3-ene back to Hex-3-yne ? 1.5×2+2=5

(g) What is 1,3-diaxial interaction in cyclohexanes ? How does it affect the stability of the molecule ? Draw the most stable and most unstable conformers of 1,3-disubstituted cyclohexane. 1+2+2=5

(h) What do you understand by ortho-and para-directing effects of substituent groups ? Give examples for each. Explain the terms activating and deactivating group. 2+1+2=5

4. Answer ***any three*** questions from the following : 10×3=30

(a) What are different pathways via which an addition reaction can proceed ? Predict the product and propose mechanism for the following reactions : 2+4×2=10

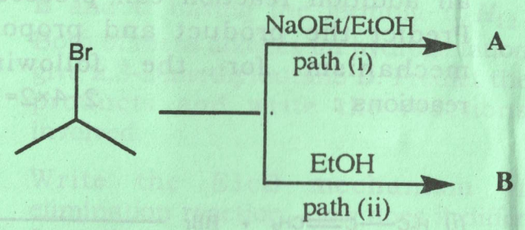
(i) $H_3C-\underset{H}{C}\equiv CH_2 + HBr \longrightarrow$

(ii) $H_3C-\underset{H}{C}\equiv CH_2 + HBr \xrightarrow{\text{peroxide}}$

(b) Draw the Fischer projections for (2R, 3S)-2-Bromo-3-chlorobutane and (2S,3R)-2-Bromo-3-chlorobutane, with the carbon chain on the vertical line. Label each structure as (2R, 3S) or (2S, 3R). Assume that you have a mixture of equal amount of each of the above compounds. What is this mixture called ? Can they be separated into two containers based on their physical properties ? Explain. 3+3+1+3=10

(c) Predict the products **A** and **B** and write mechanism for their formation.

1+4+1+4=10



(d) Oxymercuration of 3-Methylbut-1-ene followed by reduction with sodium borohydride leads to the formation of 3-Methylbutan-2-ol via Markovnikov's addition. Draw the mercurinium ion intermediate and rationalize the formation of the Markovnikov's product. Can 3-Methylbutan-1-ol also be obtained from 3-Methylbut-1-ene ? How? Is there any stereochemical control in the oxymercuration-demercuration process ?

1+4+1+2+2=10

(e) *Trans*-1,2-Dimethylcyclobutane is more stable than *cis*-1,2-Dimethylcyclobutane. Explain this observation. Draw all the different structures with the formula C_6H_{12} with only one ring and name them. Also, draw the energy profile diagram and label the position of the structures.

2+4+4=10

(f) Explain the process of racemization through cation formation with suitable examples. How would you resolve optically active alcohols from a racemic mixture ?

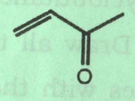
5+5=10

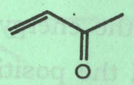
(g) Discuss SNAr and Benzyne mechanism for aromatic nucleophilic substitution reaction. Discuss effect of leaving group and attacking nucleophile on aromatic nucleophilic substitution reaction.

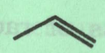
3+3+2+2=10

Contd.

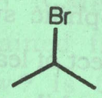
(h) Write the structure of products and reagents **(A)-(J)**. 1×10=10

(a)  $\xrightarrow[(2)\ H^+,\ H_2O]{(1)\ CH_3MgBr}$ **(A)**

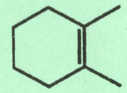
(b)  $\xrightarrow{(CH_3)_2CuLi}$ **(B)**

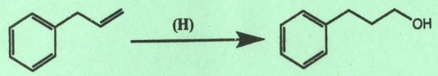
(c)  $\xrightarrow[(2)\ H_2O_2,\ OH^-]{(1)B_2H_6}$ **(C)**

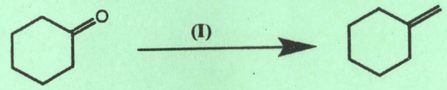
(d) $CH_3CH_2C{\equiv}CCH_2CH_3 \xrightarrow[\text{Lindler's Catalyst}]{H_2}$ **(D)**

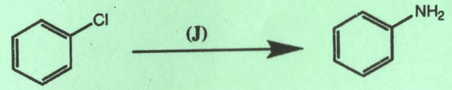
(e)  $\xrightarrow[\text{Ether}]{Na}$ **(E)**

(f)  $\xrightarrow[H_2S]{OsO_4}$ **(F)**

(g)  $\xrightarrow{RCO_3H}$ **(G)**

(h)  **(H)**

(i)  **(I)**

(j)  **(J)**